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Research Program on the Management

of Science and Technology

CONCLUSIONS FROM A STUDY OF DECISION MAKING

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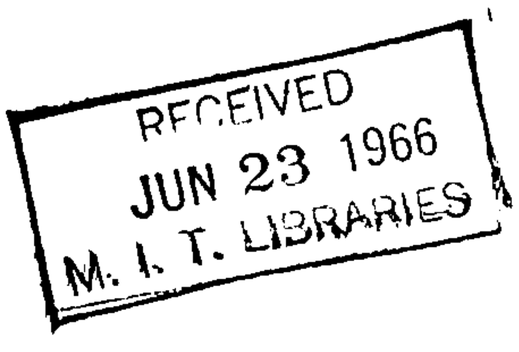

CONCLUSIONS FROM A STUDY OF DECISION MAKING

For the past two and a half years the author has plodded and waded through the following phases of a study of human decision behavior:

Phase I:

Repeated re-examination of the varied and widely dispersed literature of concepts, propositions, findings, and models of decision and problem solving behavior, for the purpose and with high hopes of finding at least one hypothesis about human choice behavior that would be:

i. reasonably central to a generalized theory of such behavior,

ii. a priori non-trivial, or at least somewhat surprising if true, and that

iii. could be made sufficiently operational to be empirically rejectable given the presently, or even conceivably, available methods of observation and experimentation.

A fourth constraint, namely that the cost of our hypothesis-testing research effort was to be kept within the means of the experimenter -- the latter budgeted to one man-year's worth of work -- never needed to be consulted, as no worthy candidate for a Critical Hypothesis was found that survived application of the first three constraints, even after repeated and certainly determined attacks on the writings of others in this field.

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Phase II: About a year's worth of non-prestructured exploration of, literally almost personal submersion in, a set of highly detailed protocol observations of a sample of "real world" decision makers' choice behaviors. The exploratory subjects were selected quite explicitly on basis of the following criteria -- that they were:

i. rather well educated, even schooled in modern decision theory;

ii. highly involved in their decision-to-be-made personally, i.e. that the latter was both an explicit as well as very important choice for them to make "right";

iii. rather unfamiliar with the particular type of decision context facing them -- having faced few if any such similar choices before, and not expecting to do so again in the immediately forseeable future;

iv. in almost complete control of the choice themselves, personally -- essentially to ensure that as few as possible, experimentally unobserved interpersonal, inter-group, or organization influences brought themselves to bear on the focal person making the decision;

v. easily (and inexpensively) accessible for repeated and highly detailed probing observations of their decision-making thought processes over the periods of their choices, which would in turn most desirably

vi. occupy several months' time and deliberations, in order to minimize the observer measurement effects, as well as enable a reasonable number, like four or more, detailed verbal protocol observations to be made of each man's choice process over his more active decision-making period.

M.I.T. Sloan School of Management Master's and Doctor's degree graduate students, in the process of selecting their organization to participate in after graduation, seemed to fit this bill as perfectly as any real world decision-maker (Dm) readily available in reasonable numbers could be expected to. As a group they also presented the additional advantage of being stationed in one central location and ready for instant study. Furthermore, whatever hypotheses would come out of our intitial observations could easily be put to a reasonably fair first test with succeeding years' populations of presumably "similar" graduate students.

Phase III: The author's induction of patterns to his highly impressionistic hunches about the nature of the thought processes that "must have" generated these Dms' reported and observed choice behaviors, eventually resulting in the formalization of his ideas into an explicitly stated, generalizable, decision process model, here-after referred to as GDP-I.

Phase IV: Much more formalized and systematic coding of the whole mass of highly detailed interview protocol observations, in accordance with the concepts and categories of the author's explicitly stated decision process model -- including herewith the quantification and counting of operationally defined events that either supported or went against the key operational hypotheses of the model.

Phase V: Re-examination of the model and derivation from it a set of key hypotheses which, if the model was to be worth anything, should now be born out in observations of the choice behavior of any new set of similar Dms. "Similarity" was defined rather conservatively as suggested above: The following year's graduating class from the M.I.T. Sloan School of Management was tapped to be our first prediction population.

Phase VI: Design and administration of a very narrowly defined longitudinal study, employing for its measures a set of pin-point questionnaire items, the format of which was now known to be compatible with Dms' manner of thinking about occupational choice. The purpose, as we said, was to try to reject a pattern of rather surprising as well as central hypotheses derived from our GDP-I decision process model.

Phase VII: Interpretation of the results of both studies, and the systematic presentation of the author's thinking to date regarding matters of decision theory -- in a format and language that would be of interest to a reasonably wide range of readers, hopefully cutting across the traditional disciplinary boundaries of allied fields of study. The latter phase turned out, perhaps not surprisingly, by far to be the more difficult step to implement.

Our summary of conclusions from the study has been divided into the following sub-titles:

I. Review of chief empirical findings;

II. Minor empirical findings;

III. Conceptual contributions to the theory of decision making;

IV. Implications for organization theory;

V. Directions of future research.

CHIEF EMPIRICAL FINDINGS

I. Decision process phase structure

The reported behavior of Dms in the process of making their occupational choices could readily be classified as being in one of the following four or five Decision Phases, at any given point in time:

Problem Definition and/or Solution Planning;

Alternatives Search and Screening Evaluation;

Decision Confirmation; or

Post-Choice Commitment and Implementation.

The two more frequently encountered phases of this study were Search and Confirmation. Our hypotheses about the nature of Dms' Problem Definition and Solution Planning phases remained quite conjectural, as detailed observations on these phases were available from only three Dms, two of whose protocols have not yet been reported in extensio.(1)

The importance of our distinguishing between Search phases and Confirmation phases in observations of decision making is rather obvious: Consider a Dm who reports that he is presently engaged in reaching a decision -- which Dms invariably claim to be doing throughout their Confirmation as well as Search phases. And say we make some measurements on this Dm's current degree of decision Uncertainty or subjective Importance ratings of goal attributes, for example for the purpose of estimating the parameters of a Search model of choice among alternatives: If what Dm is <u>really</u> doing during this time is

constructing arguments to Confirm an implicitly pre-selected alternative, then our estimated model of his choice behavior is likely to turn out to be either spurious or wrong. And any subsequent attempts on our part to influence a Dm during his Choice Confirmation phase on the basis of such a Search theory of decision evaluation would likely be rather ineffective at best.

II. The Nature of Search

Aspiration-level Search models of choice behavior usually represent Search as an active hunt-and-find procedure, by which alternatives are discovered and evaluated sequentially, and either Accepted or Rejected before a next alternative is Searched for. Search behavior observed in this study, however, took the form of Dms' initial activation of, yet later merely passive processing of, the output from a set of alternatives Generating procedures. Several alternatives could thus be, and were, presented to Dms simultaneously, without much further initiative or discovery effort invested on their parts.

More than one alternative were therefore as a rule being evaluated in parallel by each Dm at given points in time. Evaluation took the form of a multi-stage Screening process -- also in contrast to traditional choice models -- at each stage of which Dms were thus faced with making the sub-decision whether or not to try to collect more information about the alternative being Evaluated.

The decision-to-investigate-further was usually made quite simply: If the alternative was not Rejected by Dm at its last Screening stage, for failing on one or more "necessary" goal-attributes, then Dm would decide to Investigate it further, unless he happened to believe that additional information about the alternative either:

i. was not available,

ii. could not be obtained using the Search resources at his disposal, or

iii. was not going to modify his prior evaluation of the alternative's being ACCEPTABLE according to most of his important goal attributes.

III. Search termination point.

Aspiration-level models have their Dms terminating Search for alternatives as soon as one of these has been found to be Acceptable, i.e. does not violate any or the majority of Dm's goal-attribute constraints. Dms in this study did not terminate Search simply because an Acceptable alternative had been located. Indeed more than a single alternative was generally considered by Dms to be Acceptable at their respective points of Search termination. The latter point in time occurred when either:

a. Dm ran out of Search resources for solving the problem at hand, or

b. a Favoritely Acceptable alternative had been discovered -- the latter being one which scored OUTSTANDING on one of Dm's Primary goals, and which exhibited few if any obvious defects along his Secondary goals.

IV. Multiple-goal weighting functions

Dms did not select among alternative courses of action by applying some form of substitutional or inter-comparative weighting scheme to their respective alternatives' scores along whatever set of goal-attributes or Value dimensions Dms claimed to be "important" to their final decision. The following seems to be a more reasonable description of the observed Evaluation processes:

Alternatives which obviously violated one or more of Dms' important goal attributes were first quickly Screened from further consideration, at whatever Search-evaluation stage this state of affairs was discovered. Dms' actual selection, however, of one from the residual set of potentially acceptable alternatives, was effected by their consulting merely one, two, at the most three (Primary) goal attributes.

Only then, when selection of a Favoritely Acceptable alternative had been thus accomplished, did Dms seem able, or willing, to talk explicitly about their relative "trade-offs weights" among all the (other) Values that they said were important to the making of their decision. But note, these trade-off weights were usually described with direct reference to the specific circumstances of the particular alternatives Dms had already either Accepted or Rejected implicitly -- and as such merely contributed to each Dm's at times laborious construction of an acceptable intellectual argument for why his choice indeed "should" be resolved in the manner that he felt "intuitively" was the more appropriate.

We may restate the proposition in slightly more dramatic language: Dm first decides which alternative he is going to select. Only then is he able and willing to talk about the relative "weights" that he assigns to his various "important" goal dimensions.

Utility-type decision theories generally assume the reverse sequencing of events to be more descriptive of Dms' choice processes, i.e. that each Dm has initially available to himself some set of "weights" or ordering over goal attributes, which is (would have to be) somehow measurable a priori -- usually expressed theoretically as some form of explicit Utility function -- defined over the domain of all goal attribute values. By consulting this goal function a Dm is presumably able to evaluate and rank order whatever choice alternatives set he might encounter, in any novel or familiar problem context.

But if the latter type description is anywhere near an accurate way of conceptualizing Dms' goal structuring and alternatives evaluation processes, then it should make little or no difference to our measurement of his goal-attribute ordering scheme whether we perform these observations before or after Dm has encountered the alternative that he eventually ends up choosing -- or indeed whether we measure his (Utility) goal function with specific reference to either one, the other, or neither of his presently available choice alternatives. It has been demonstrated in this study that it certainly does make quite a bit of difference, at least if we are to accept Dms' own words and questionnaire responses for it, in just what problem context, as well as in what decision phase, we happen to measure Dms' relative ordering schema for their various "important" goal attributes. Rather dramatic shifts in Dms' assigned goal attribute "weights" were observed over the course of their occupational decision making.(1a)

V. Decision prediction

The more spectacular consequence of the GDP-I model perhaps is the ability it gives an observer to predict, sometimes weeks in advance, the exact decision alternative a Dm is going to end up choosing -- without, as in the case of most all of the highly "programmed" decision processes studied to date, our having to observe beforehand the specific parametric decision rules that Dms in such choice situations often do seem to have developed cranking out their choices.(2) Indeed "programmed" decision rules, in the sense of a Dm's alternatives Evaluation and consequent Choices' being almost trivially predictable in advance, were not obviously derivable in the typically "non-programmed" decision context that we have investigated.

It is the GDP-I model's identification of i. the existence of, and ii. the nature of, Dm's Confirmation processing of choice alternatives that provides us with this, in retropsect not so surprising, power of "clairvoyance." In a sample of 32 M.I.T. graduate students seeking "organizations in which to participate", that is to say, jobs, we turned out to be exactly right 80% of the time when we selected in advance, at whatever time Dms reported their Search for new alternatives to be terminated, a single specific alternative to be each man's Choice Candidate -- in spite of Dms' own (and usually HIGH) expressed Uncertainty at the time of our prediction regarding which of the set of available alternatives they would eventually end up selecting.

VI. The purpose and nature of Confirmation processing

However redundant Confirmation processing might seem to an observer who knows what's going on, and in retrospect often to Dms themselves as well, the Confirmation phase serves several decision making functions. In other words, if the reader knows what he wants to mean by the term; Confirmation processing is in many respects quite "rational".

First of all, there is definitely a need during decision making for Dms to face up to, and somehow to resolve, the ubiquitous if admittedly no longer overriding "problems" that still remain with respect their Choice Candidate, arising in part from:

a. residual uncertainties, or other-alternatives' dominance of the Choice Candidate, along important goal attributes;

b. questions in their minds regarding the importance of certain unique or "unusual" characteristics of the Choice Candidate;

c. Dms' longer-term, less detailed questions at the point of Choice regarding consequences of the impending decision for their overall (career) Planning goals; and/or

d. the quite practical consideration connected with implementation of the Choice in the (occupational) task environment.

Secondly, unless his Choice Candidate pareto-dominated his other alternatives on all important goal attributes a Dm would have to resign himself to, at least feel a need to rationalize, the fact that he had to reject perfectly good, non-dominated alternatives in order to commit himself to his Choice. Some persons, surely those of Puritan background, appeared quite reluctant to throw out their good potatoes with the bad ones. This seems to be part of the reason that decisions were often reported "hard" to make.

Thirdly, utilization of a Confirmation process reduced rather spectacularly the computational load on Dms' de facto alternatives selection procedures. If Dms indeed need to consider only one or two Primary goal-attributes when selecting an alternative from a set of pre-screened Potentially Acceptable ones, such that their consideration of the selected alternative's non-dominating, uncertain, or otherwise conflict producing goal-attribute scores is postponed to some point later in decision making, then the mathematics of Dms' choice-from-alternatives becomes an order of magnitude simpler and more manageable intellectually -- and thus a priori more believable -- than any of the ratio, cardinal, ordinal, or lexicographic scaled multi-dimensional attribute weighting schemes proposed by decision theorists to date.

Fourthly, on the other hand, utilization of Confirmation procedures in decision making yielded some other, rather anamolous, or "irrational", side-effects: The decision rules produced by Dms' Confirmation processing,

presumably erected in order to ensure the explicit "rationality" of their respective decisions, would on occasion prevent a Dm from recognizing, and thus lead him to reject out of hand, a perhaps even more rational choice, in terms of his "actual" goal structure, if such an "in fact better" alternative happened along after Dms' Confirmation decision rule had been fairly well explicated.

In other words, since Dms' explicit post hoc Confirmation rules were usually different from the much simpler discrimmination procedure by which they had originally made their Implicit Choice, it is only reasonable that the preference orders produced by the two methods of calculation, with respect to two or more alternatives, will not in general be isomorphic. Thus we observed how hard-to-change cognitive Intolerance and pre-choice Prejudice appeared in highly "rational" decision makers.

VII. Dissonance reduction phenomena

The last of what we have labeled our chief findings is a modest empirical clarification and theoretical elaboration of the familiar Heider, Festinger, et al, Dissonance Reduction notion. It is this writer's present opinion that Dissonance Reduction is a rather misleading name for a symptom of some Dms' choice information processes. It's existence, according to the originators of the concept, is to be recognized empirically by observing increases in a Dm's reported "Liking" or rated cognitive "Difference" between his Accepted and Rejected alternatives, respectively, from the point in time when Dm has announced and thus become committed to his Choice.(3)

A more pleasing explanation of the affective and cognitive "spreading apart" phenomena associated with Dissonance Reduction runs as follows: From the point in time of their Implicit Choice Dms' engage in a continuing process of "intellectualization", as well as feasibility testing, of their choices. Before this intellectualization, i.e. construction of an explicit decision rule for explaining his Choice, is an accomplished fact a Dm tends to compensate "emotionally", perhaps even perceptually, for his lack of explicitly cognitive decision rationale. An observable symptom of this compensation is then the noted Dissonance-Reduction amplification of a Dm's reported Liking differential between Chosen and Rejected alternatives. But as Confirmation progresses, a stronger and stronger cognitive argument is built for why the Choice Candidate is indeed best, as a result of which the emotional and/or perception-distorting symtoms of Dm's affective rationalization process can be, and are, progressively relaxed.

According to this model the celebrated Dissonance-Reduction phenomenon may or may not be observed after Confirmation processing has been "officially" brought to a close by Dm's acts of Choice announcement and commitment. Yet the same model, by a slight variation in its Intellectualization-process versus Choice-announcement timing parameters, will also produce predictions that the traditional Dissonance-Reduction measures peak after the point of Choice Announcement-Commitment, which, according to Festinger, is when Dissonance properly "should" occur.(4)

Nevertheless, our "intellectualization" model of decision making will always predict that Dissonance Reduction symptoms, whether they occur post-Choice or not, will subsequently abate some time after Choice has been announced: Dms' developing explicit decision rules, when the latter finally achieve full cognitive rationality, sooner or later allow Dms to relax their affective or "subconscious" compensatory efforts. In the questionnaire decision-process study referred to above this "recovery" characteristic of Dms' post-Choice Dissonance-Reduction measures was clearly demonstrated, for that subset of Dms whose relative Liking-of-alternatives did exhibit any form of Dissonance Reduction Spreading-apart.(5)

MINOR EMPIRICAL FINDINGS

1. Alternatives evaluation reservation

Dms' evaluation of any alternative did not appear to be independent of:

a. their personal estimates of whether or not the alternative in fact was within their reach, i.e. whether a Dm thought he would obtain the alternative should he decide that he liked it, and/or

b. what, i.e. how highly, the alternative in turn is thought to think of Dm.

In other words, a job-alternative from which a Dm had not yet received word of an offer tended to be rated at less than the full value Dm would later assign to it, when the alternative finally became feasible, i.e. had indicated that they would be making him an offer.

It is almost as if Dms "hedge their bets", in case they may have to protect their self-esteem by deciding, subsequently, that they did not "after all" like some rejecting alternative as well as they initially thought they might have.

2. Post Search-termination follow-up

Dms do not stop investigating previously uncovered, but yet not completely evaluated alternatives at the same time that they quit looking for new alternatives. In fact in only rare cases did Dms not follow up to the bitter end those alternatives they had started to look into prior to Search termination, even though at this time, or shortly thereafter, their Choice Candidates had already been implicitly selected.

3. Refusal to admit Choice after Confirmation commencement

Although both our interview protocol, and subsequent questionnaire decision-process, studies turned out to yield quite reliable batting-averages for our ability to predict Dms' eventual Choices at time of Confirmation commencement, in just about every case did these same Dms deny, either explicitly or by their assignment of relative "final choice" likelihood indices, that their selection of the alternative that was to be their Choice had indeed been accomplished, until at or very close to Confirmation termination.

4. The common meaning of "choice among alternatives."

Dms' who were left with only one Acceptable alternative at the time of Search termination expressed feelings of being faced with a "dilemma". More specifically, they felt that they did not have, and wished they had been provided with, "a choice to make". In other words, rejecting a lot of rather easily Rejectable alternatives and thus being left with merely one Acceptable one, was seen by Dms -- contrary to the predictions of Aspiration-level theory -- as somehow depriving them of their "freedom of choice." In other words, it seems as if at least two Good alternatives or candidates for Acceptance are needed in order to make the illusion of "free choice" workable!

5. Final Confirmation of one's Choice involves two and only two alternatives

Although several of our Dms in the interview study reported more than two alternatives to be Acceptable--as places they would gladly go to work for--at the time of their Search termination, it did not take them much Confirmation processing to reduce this set to two, and only two, alternatives -- which we then labeled, respectively, their Choice and Confirmation Candidates.

their Confirmation processing by focussing on merely <u>two</u> alternatives for their alternative-by-alternative comparison of choice possibilities. (Remember, up until this point in their decision making Dms had evaluated alternatives "absolutely", on their own merits, one by one, and had carefully avoided making inter-alternative-comparison computations, except for simple Pareto dominance checks among socalled "similar" alternatives.)

The functional reason for Dms' utilizing a Confirmation Candidate for their final decision deliberations is fairly obvious by our interpretation of the process. Dm's final decision rule, his explicit rationale for why he chose the way he did, is in large part relativistic, i.e. a Dm claims he Decided not <u>merely</u> because his Choice Candidate was GOOD or OK along certain critical dimensions, but "because" the latter was BETTER than some other, also seemingly reasonable alternatives. Utilization of a single "second-best" alternative would be the simplest and most expedient way for Dms to represent the set of 'all other' alternatives: The very idiosyncratic decision rule that explains how Choice beats the Confirmation Candidate can then become, by fiat of semantic generalization, Dms' basis for reasoning that their respective Choices must be "best" relative to "all other alternatives."

<u>Caution</u>

What has been summarized above as being our various "chief and subsidiary empirical findings" are to a large extent based on the author's interpretation of often quite disturbingly small samples of observations. The reader must therefore be referred to our much less aggregated analyses of the observed decision process data, reported elsewhere,[6] in order to learn from them to exercise the proper caution in accepting and generalizing from the above-interpreted findings.

CONCEPTUAL CONTRIBUTIONS TO THE THEORY OF DECISION MAKING

The two notions, Utility and Probability, have too long reigned the field as the chief conceptual building blocks of behavioral decision theory.(7) Part of the reason for this state of affairs surely has to do with the rather pleasing analytical elegance of mathematical Probability/Utility language. Moreover, at least in the eyes of theorists who have not troubled to look much further, it may seem obviously obvious that human decision makers "must" utilize some version of Utility for imputing Value to choice consequences, as well as some version of Probability for representing differentially perceived Uncertainty about whatever consequences they believe might follow their selection of any one choice alternative.

Yet one cannot help suspecting that part of the reason why Utility and Probability continue to dominate the field, in spite of some obvious objections to their reasonableness empirically, must be that decision theorists have generally felt hard put to think up conceptual alternatives to these notions. The sole contributions in this regard, up until very recently, seem to have come from the pens of either H.A. Simon or G.L.S. Schackle.(8)

Below then follows a brief inventory of the author's own beliefs and disbeliefs at present about what seem to be computationally reasonable, as well as even conceivably interpretable, concepts for us to invoke when constructing descriptive models of human decision behavior.

Scalar Utility

Scalar Utility concepts -- whether cardinal or ordinal -- will have to be rejected out of hand, most obviously on grounds that:

i. their conceptual definitions are generally impossible to interpret empirically, except for certain cases of extremely stylized and therefore hard-to-generalize laboratory task environemnts; and that

ii. complete and parametrically constant substitutability of Value over the relevant ranges of their various Value dimensions -- a necessary and central requirement for Scalar Utility -- has been impossible to impute to actual Dms on the basis of detailed reports about their choice behavior.(9)

Multidimensional Weighted Utility

Multidimensionally Weighted Utility notions fare even worse than the Scalar Utility idea, even if we disregard the obvious objections raised by the non-substitutability of goal dimensions argument. If any sort of Weighted Utility is to work arithmetically it requires Dm to scale Value along all of his many Utility dimensions, or goal attributes, according to an explicit or underlying ratio-scale -- one possessing a unique Utility zero-point as well as fixed-length unit Utile. Thus, even though the "multidimensional" notion may sound reasonable initially, the imposition of any Weighting requirement along various Value dimensions implies that Dms indeed perform greater computational feats than have to be assumed by Scalar Utility.

Lexicographic Utility

Lexicographic Utility answers the Weighting criticism head on. As Chipman has shown, Lexicographic Utility is a general class of orders from which Scalar Utility can be derived analytically merely by imposing on them the axiom of Substitutability.(10) Lexicographic Utility is thus much more attractive to empiricists due to the more modest claims it makes about Dm's ability to compare Values along different goal dimensions.

But Lexicographic Utility is unreasonable in other ways. It imposes on Dm the constraint that he possess a fixed and linear order among all his goal attributes or dimensions, such that an alternative's being Better or Satisfactory on a "higher order" attribute will always be a sufficient condition for Choice or Acceptance to be made, regardless of what the alternative's rating might be on any other, "lower" goal dimension. Thus it seems that we have thrown the Multidimensional baby out with the Weighting bathwater -- as in most cases we might expect only the one or two "top" goal attributes to exert effective decision making power.

Yet stop a moment. There does exist a class of decision problems for which a resonably pure lexicographic may exist among Dms' goal attributes. If such ordering is not linear over individual attributes it may at least be linear over <u>subsets</u> of attribute constraints: In decision problems defined by recursive application of socalled "means-ends" heuristics, such that a <u>hierarchy</u> of attributes is derived, flowing from a single meta-goal measure, it might indeed be appropriate to recast Dm's Value structure into Lexicographic terminology.(11)

Multidimensional Constraints (or Aspiration-levels)

Simon's Multidimensional Constraints notion[12] does away with all ordering among goal attributes. Every goal dimension is thus conceived of as being just as "important" to Dm. Violation of any one of them will then be sufficient cause for him to Reject a choice alternative; or else to modify the constraint or Aspiration-level being violated. In Simon's dynamic models both of the latter events are predicted to occur, but at different rates.[13]

Problems arise with the Multidimensional Constraint notion under the following, empirically quite common conditions: i. Dm is faced with two or more Acceptable alternatives, among which he has to pick one; ii. Dm is left with no alternatives that are Acceptable according to his Multidimensional Constraints, yet he needs somehow to arrive at a choice of one from the set of initially Rejectable alternatives.

The conceptual problem thus identified seems to arise because the Multidimensional Constraints or Aspiration-levels notion is a bit too simple. It appears that we will have to assume that Dms possess, and are able to utilize, some notion of order among goal-attributes -- hopefully a stable and a priori empirically measurable one -- in order that we be able to explain how Dms resolve either of the last mentioned types of decision conflict.

Primary-Secondary-Auxilliary Goal Attributes

The notion suggested by the author is one of a simple dual, in rare cases perhaps tertiary, ordering among sets of Dm's goal attributes:

i. "Auxilliary" attributes would be those largely void of decision power, that seem to be employed by Dms for elaborating a rationale for "why their choice is best", once it has been determined.

ii. "Secondary" goal attributes serve as a set of semi-independent, although by no means orthogonal, constraints on Dm's decision. We will expect a Dm to possess a critical Rejection threshold, i.e. a "necessary" level of Value, but not to exhibit an Automatic Acceptance (Aspiration-level) threshold, i.e. "sufficient" levels of Value, with respect to his Secondary goal dimensions. For certain classes of problem definitions Dm's Secondary goal attributes may be shown to have been derived as the "means" in a single-stage or few-stage means-ends analysis of his problem.

iii. "Primary" goal attributes would then possess the full-dress dual set of "critical Value" levels: a Rejection level, below which any alternative would be immediately rejected, and an Acceptance level, above which the alternative would be immediately, if first only implicitly, accepted -- provided that the alternative did not simultaneously violate Dm's other Primary and Secondary Rejection levels.

Ties among Potentially Acceptable alternatives, i.e. cases with none Automatically Acceptable but with two or more alternatives falling "in between" on Dm's Primary goals, and "above" on his Secondary ones, would, we hypothesize, be resolved by Dm's focussing on, and imposing a somewhat finer, semi-cardinal scaling of, his Rating of the conflicted alternatives

along his Primary goal dimensions alone, according to a decision rule of the type described in detail by the author in the above-mentioned generalizable decision-process model presentation.(14)

Probability

Mathematical probability theory, either of the Neyman-Pearson or Baysean variety, seems quite unsuited as a source of concepts for describing how Dms code and operate with perceived Uncertainty, even in the limited context "perceived inability to predict exactly the consequence which would flow from choice of a given alternative". These are the more obvious reasons:

i. Additivity, i.e the distributive property that all Dms' Probability Uncertainty indices must add up to "one", or Certainty, over the set of all possible and mutually exclusivë consequences of any given alternative, is a computational constraint that Dms do not generally seem to (have learned to) apply in their own estimation of Uncertainty "indices".(15)

Shackle invented his non-additive Potential Surprise concept to cope with this objection to formal Probability theory. Unfortunately the computational assumptions that Shackle sees fit to impose on his Potential-Surprise calculating Dms are so severe that not much empirically descriptive reasonableness seems to remain by the time Shackle has finished putting all his suggestions together into a complete theory. However, the reader must be referred elsewhere for more detailed discussions of Shackle's Potential-Surprise ideas by this author.(16)

ii. Probability theory requires that Dm's coding of Uncertainty be continuous as well as intra-alternative ratio scaled. Whereas the first property may not constitute a serious objection to our adoption of Probability theory as a reasonable way of representing Dm's differentially felt Uncertainty among consequences -- as we can readily imagine a step-wise, finite Probability theory -- the assumption does raise the following questions, which can only be settled empirically;

a. Just how large a "just noticeable difference" interval are, are we to assume that Dms utilize for purposes of our finite theory of probability, -- is it, for example, more reasonable to assume a Binary or a Digital Probability scale ?

The choice of scale-division is important because it in turn helps determine what might be reasonable rules of Probability transformation to assume. For example, in the Binary case, allowing for expression of merely HI versus LO Probabilities, the logical union ("multiplication") of two LO Probabilities might be reasonably assumed to yield another LO Probability. Similarly the union of a Binary HI and a LO Probability would also be expected to yield a LO Probability, etc. However, if we assumed or found by observation that Dm's Probability discrimminations were more nearly Tertiary, then the union of a HI and LO Probability could more likely be expected to yield MEDIUM Probability!

To add further to the confusion: There exists evidence 1. that Dms are able to discrimminate quite fine jnd's among serially presented objective-frequency samples,[17] i.e. that Dms possess a perceptual apparatus which in principle would be more than adequate for coding reliably quite fine discriminations indeed among Frequency Probability quantities; yet 2. when operating with Uncertainty in actual choice situations behave pragmatically as if symbolically they utilized much rougher shades of decision "Probability" than they are thus presumably capable of. This observation could conceivably be made to support the hypothesis that Dms utilize different scales of Probability scaling, if we believed in "Probability", for different types of decision purposes -- such that a major problem for Behavioral Probability theory would be to determine, and be able to predict, under what specific circumstances a Dm would use what jnd-size for scaling his perceived Uncertainty.

b. The second scaling property of traditional Probability measures is no less disturbing: What empirical assurance have we got that Dms indeed perceive and code Uncertainty in the required ratio-scaled manner -- e.g. that Dms would not be more appropriately described as utilizing a "rubber-ruler unit" cardinal scale, or else as perceiving merely ordinal differences among Uncertainty "quantities, if indeed Dms can be assumed to impose or utilize any sort of systematic ordering on whatever "Uncertainties" they appearantly do associate with (otherwise often uncompared) multiple outcomes of their decision alternatives?

In other and hopefully somewhat plainer words, has anyone ever been able to demonstrate empirically the existence of Dms who behave as if they utilized Probabilistic Risk Uncertainty in their decision making, in contrast to its hitherto only conceptualized theoretical alternative, namely non-Probabilistic "Pure" Uncertainty? That the distinction between differentiated "Risk" and undifferentiated "Uncertainty" is nice to talk about in analytical terms does not, obviously, imply that the concept also will be useful in empirical analyses. In the paragraphs below we will suggest to the reader an alternative, and perhaps empirically more reasonable, way of conceptualizing a Dm's representation of "differentiated decision Uncertainty".

iii. An unquestioned implicit assumption of all applications of mathematical Probability theory is that Uncertain Dms perceive multiple factual Consequences as possibly flowing from their Choice of any one alternative. The classical conceptual paradigm may be pictured thus:

$$\text{Alternative}_1 \longrightarrow \begin{cases} \text{Consequence}_{11} \longrightarrow \text{Utility}_{11} \\ \text{Consequence}_{1i} \longrightarrow \text{Utility}_{1i} \\ \text{Consequence}_{1n} \longrightarrow \text{Utility}_{1n} \end{cases} .$$

over which Consequences set, i = 1 ... n, Dm is then thought to distribute his Probability indices. On the other hand, from our observations of decision makers in action the following seemed to be, for a majority of these cases, a more reasonable manner of representing Dm's manner of describing his alternatives:

$$\text{Alternative}_1 \longrightarrow \text{Value}_1$$

where Value_1 is a multidimensional Primary/Secondary structure of attribute Values, of the type already described above.

The theoretical distinction between these two paradigms is important, and will be described in two parts below:

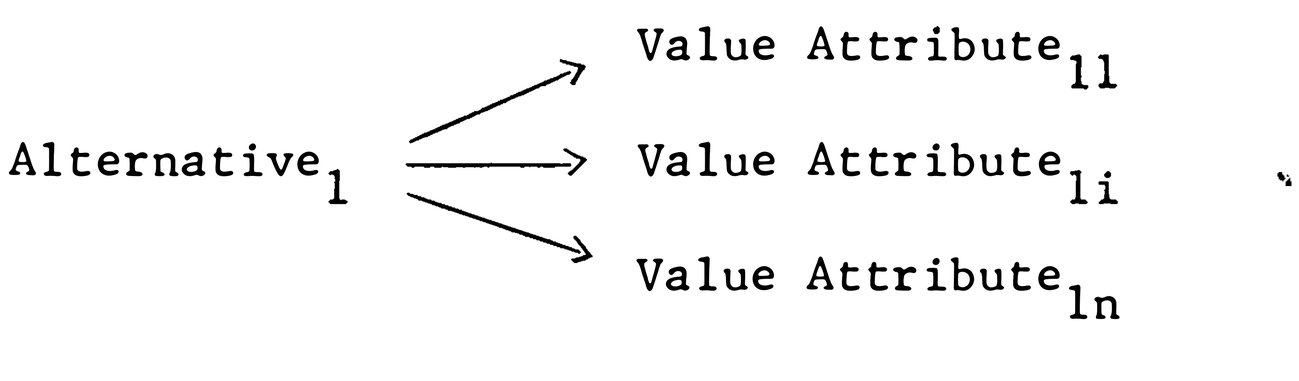
a. The philosophy-of-science distinction "Fact versus Value", implied by the "Consequences versus Utility" categorization of classical decision theory, seems not to be reflected in most Dms' coding of the elements of their choice problems -- save in the highly stylized and quite unrepresentiative instance of carefully Probability-instructured experimental subjects who are asked to make choices among explicitly experimenter-defined-as-multiple-consequences monetary betting alternatives.(18)

It seems that Dms regard factual Consequences and judgemental Values as being generally interchangable attributes, any combination of which may be used to describe a given decision alternative at a given point in time:

Indeed Dms appeared to map available alternatives onto their Value structure as quickly as possible, usually without bothering to identify the external event-set with respect to which factual consequences might be defined. But if a factual attribute measure over consequences happened to be available, and was isometric with Dm's Ordering of Value over alternatives, such as say Salary and Company Profit figures might be, this provided a convenient shorthand or dual set of languages for Dm to express his Evaluation of the alternatives on those goal attributes.

b. Dms, at least for the problem context in which we studied them, described alternatives as if, in the terminology of Probabilisitc decision theory, each one merely had a unique Consequence associated with it. In other words, no more than single-stage deep "if-then" means-ends analysis was invoked by Dms when evaluating choice alternatives, and, at this first "if-then" level, not more than one state-of-the-world consequence description was usually associated with each alternative. Should this then be taken to mean that our Dms behaved as if they were making decisions under Certainty, i.e. that decision Uncertainty is a concept redundant for describing choice of the type that we studied?

By no means! Uncertainty was reportedly real enough with most of the Dms observed. It's just that they seemed to represent it differently than what current "Probability Risk" theories prescribe. The author has proposed using the following vector paradigm for conceptualizing Dm's "felt differentiated Uncertainty" of a choice alternative:



wherein any Value-attribute may be Uncertain in the sense that Dm refuses to, i.e. feels unable to, specify a unique Value rating of the alternative along that particular goal dimension -- in which case Dm simply resigns himself to considering the alternative as having a "probable" Value range along the

Uncertain goal attribute. "Probable" does not at all imply a form of distributive Probability. It merely indicates, in Dm's manner of thinking, that the true Value rating is LIKELY -- uniformly distributed as it were -- to exist <u>inside</u> those range limit-points, and UNLIKELY to be found to fall outside this range.

Thus, with no more sophisticated notions than "Likely/Unlikely" and an undifferentiated "pure" Uncertainty range measure in multidimensional Value-attribute space, are Dms able to conceptualize and compare Uncertain decision alternatives in a manner well-nigh as differentiated and computationally sophisticated as any "expected value" arithmetic so ceremoniously prescribed by ratio-scaled mathematical Probability theory!

Just <u>how</u> Dms operate with this, what we might call Possibilistic form of Uncertainty, i.e. how Dms are indeed able to compare and rank order alternatives, the Uncertain Values of which are described in the manner suggested, is a subject we do not have enough space to dwell on at this point.(19) Even so, the following, our last, conceptual-empirical criticism of traditional Probability notions goes part of the way in suggesting how this writer has reconceptualized Dms' manner of operating with Uncertain alternatives in a choice situation:

<u>iv</u>: In classical decision theories Search is not even a relevant concept, all available alternatives and information are presumed to be provided to Dm beforehand. In neo-classical Aspiration-level theory Search is a central concept, but only in the sense of Search-for-new-alternatives.(20) However, Search-for-information <u>within</u> found alternatives, what we might simply call "Investigation", is an obvious aspect of most decision deliberations.(21)

Our criticism in this regard of traditional Probability choice paradigms then follows directly:

Probability theory assumes that Dm codes his felt Uncertainty as if it were the functional equivalent of a mathematical operator, with which he is then presumed to modify his rated Value (Utility) of the Uncertain alternative. Whereas we believe, obviously, that what most Dms do in most cases is to treat felt Uncertainty -- represented as goal attribute range ratings just indicated -- not as an operator but as a decision variable: "Too much" Uncertainty will trigger Dms to go out and Investigate (Search) that alternative further.

In this respect we might hypothesize that Dms possess the equivalent of a Rejection-level "tolerable" Uncertainty. But the latter notion, on second thought, is seen to be a slippery and probably useless concept, since any Dm's "Uncertainty Rejection-level" would surely vary with the current Phase of his decision process, as well as with the specific circumstances of the particular set of Uncertain alternatives among which Dm might want to discrimminate "more certainly".(21)

Search for alternatives

The Search for alternatives notion is another decision theoretical concept variable the present study has served to clarify. In the usual Simon type Aspiration-level models Search is conceptutalized as an active "hunt-and-find" process, whereby new choice alternatives are actively located sequen-

tially and then immediately evaluated by Dm, one at a time.(22) In view of our observations, however, it would seem wise to differentiate among at least three rather distinct forms of Search-for-alternatives behavior, each one of which appears to be more appropriate for describing Dms faced with correspondingly different types of decision problems. The three types we have in mind are problems characterized largely by either:

a. Hunt-and-find (HF) type Search;

b. Generate-and-screen (GS) type Search; and

c. Design-test-and-modify (DTM) type Search, respectively.

Active HF-type Search needs no further discussion here.(23) Generate and-screen type Search turned out to be the predominant mode of locating and evaluating alternatives used by Dms in an occupational decision context. GS-type Search is generally characterized by:(24)

i. the passive role played by Dm in indentifying new choice alternatives, once he has activated his Search Generators;

ii. the parallel presentation of, and Dms' simultaneous evaluation of, multiple sets of alternatives; and

iii. the successive Screening of alternatives with respect to certain goal-attribute constraints, which rapidly and efficiently reduces the large set of generated alternatives down to a computationally more manageable sub-set for a "final round" of selection.

Design-test-and-modify type Search has yet to be studied in adequate process detail by this writer, but reasonably pure examples of DTM-type Search should come out of studies of behavior in Research-and-Development type problem contexts. Briefly, DTM-type decision problems would be characterized by:

i. the lack of a well-structured definition of Dm's task environment, with respect to which he might conceivably have administered Hunt-and-find type heuristics;

ii. an appearant lack of effective Generators with which to produce a set of even minimally acceptable choice alternatives;

iii. Dm's focus on one, or at most two, Design Bases, i.e. rough outlines of a decision alternative, within the broad initial specifications of which Dm will then Search cumulatively for a viable solution that satisfies his problem's Primary and Secondary goal attributes.

DTM decision processes would thus not easily be describable in traditional "discovery and subsequent evaluation of well-defined alternatives" terms.. More typical of DTM Search would be Dm's efforts to derive, and then satisfy, successively more operational and detailed problem/goal attributes with respect to a single alternative -- or, in other words, his trying to come up with new ideas and workable methods for overcoming the set of (partly hierarchical) constraints on his Design Basis that his recursive DTM Investigation of that alternative kept leading him to identify.

Alternatives Evaluation

Traditional models describe Dms' alternatives Evaluation as if it were a one-shot Value-assignment-to-received-consequences transformation. This study suggests that we revise this notion and hereafter consider Alternatives Evaluation to be a two-step process, consisting as it were of

a. Search Evaluation and

b. Confirmation Evaluation, successively.

Let us only briefly summarize the main characteristics of each Evaluation phase: Dms' initial Search-evaluation of any one alternative seems better described as a multi-stage Investigation and Screening procedure, at each stage of which Dms are faced with an opportunity to decide whether or not to engage in another round of Investigation of the alternative. In other words, at each intermediary stage a given alternative is evaluated only partially by being Screened over whatever sub-set of his Primary and Secondary goal-attributes Dm has till then managed to obtain sufficiently Certain information about -- i.e. is willing to assign a sufficiently narrow range of LIKELY Value ratings to, relative to his Screen Reject levels.

During Search-evaluation each decision alternative is in effect evaluated "absolutely," i.e. each of the latter's goal attribute Value ratings is compared, semi-independently of all of Dm's other goal attributes or alternatives, to that attribute's own Rejection level, and, if the attribute in question happens to be a Primary Value, to its Acceptance-level as well.

To elaborate just a little on this point, during initial Search-evaluation a given alternative does not need to be, and is in fact not, compared to any of Dm's other choice alternatives -- except for a quick check for possible Pareto domination by a Dm-perceived "similar" and also Potentially Acceptable alternative. In short, during Search-evaluation Dms' alternatives get themselves merely rejected, such that in only the rare case will a given alternative be Accepted immediately simply because it happens to be found Acceptable.

Thus Dms will usually terminate their Search for new alternatives with more than one Acceptable alternative actively under consideration.

During Confirmation-evaluation the emphasis then shifts to Dms' "relative" comparison of their alternatives. But, as already noted, all too frequently perhaps, by this point in their decision-making most Dms' seem largely to have accomplished the Selection of which particular alternative, from their "active" sets of Available Acceptable ones, is eventually to become their Final Choice.

Thus Confirmation-evaluation of alternatives takes on a flavor of post-hoc "irrational" rationalization. Yet there is little doubt in the writer's mind that this step in Dms' alternatives Evaluation serves quite functional purposes -- besides fulfilling Dms' need-for-intellectualization of their already implicitly "felt" choice biases: The process in effect enables a Dm to concentrate his attention on resolving whatever problems might remain with respect to his Favorite alternative -- as we said, commonly due to the latter's Secondary Uncertainties, or possible constraint violations, and/or the Favorite's being dominated by another, almost-as-good alternative along important goal dimensions -- before he at last commits himself publically and unconditionally to follow his "intuitive", i.e. Primary-goal, feelings down the garden path to Final Choice.

IMPLICATIONS OF THIS STUDY FOR THE THEORY OF ORGANIZATIONS

That the manner in which human beings make decisions critically influences the behavior and thus our theory of organizations no longer needs lengthy arguments to get established, particularly not in view of the by now fairly general acceptance of March and Simon's development of this viewpoint in their progrmmatic epic, Organizations. Nevertheless, although the theory of individual choice behavior espoused in this study differs in rather important respects from the more elementary Aspirational-level theory utilized by March and Simon for developing their half-hundred or so hypotheses about organizational behavior, we shall not take the space here to go into each and every one of the latter in detail -- something we conceivably ought to do in order to convince ourselves anew that the March-and-Simon propositions are as a priori reasonable now as they seemed to be before we embarked on our pedantically detailed observations of real-life decision makers.(26)

¶ We have instead selected, somewhat discrimminately we hope, no more than four organizational behavior hypotheses on which to focus this initial attempt to draw the more obvious organizational implications of our revised individual-Dm theory of decision making. The propositions have been labeled as follows:

A. Organizational participation;

B. The role of organizational versus personal goals in organizational choice;

C. Individuals' power to influence organizational decisions;

D. Organizational innovation implementation.

A. Organizational participation

One immediate implication of our revised model is that individuals' organizational participation decisions, i.e. Dm's choices whether or not to leave or join a given organization, is expected to be more stable and difficult to overturn than proposed organizational participation models might lead us to expect.(27)

The more prominent of these models, the Barnard-Simon "inducements-contributions" theory, states quite straightforwardly that Dms will leave or switch organizations whenever their total Scalar Utility, i.e. "inducements", received from their current organization is less than the total Scalar Utility, i.e. "contributions", offered by some other organization. The empirical content of the proposition depends critically, some might claim disasterously, on our ability to interpret empirically and to measure a priori a Dm's "total Scalar Utility" received from, or expected to be received from, each one of his currently inducing organizations.

Nevertheless, we can argue about an implied difference between the Barnard-Simon participation model and ours even at a perfectly inoperational, meta-theoretical level of explanation: Let us for comparison purposes extrapolate the Barnard-Simon assumption of Scalar Utility by imputing to their theoretical Dms the ability to order inducements/contributions in multidimensional space. The only Utility axiom we would need to preserve in order to complete our argument is a generally invoked one, not relinquished by any scalar Utility theory, that Dm's Total-Utility of a given alternative increases with any increase in his Utility rating, or "additional amount received," in any of Dm's goal-attribute dimensions.

is going to swing Dm's Decision to Participate in its direction. This basis for choice among organizations in our competitive world of close economic races--where prices paid for products or persons by all surviving companies in any industry tend to adjust so as to equalize each company's relative "competitiveness", i.e. equalize their "total packages" of offered job Inducement Utilities-- would lead us to predict the existence of a highly volative game of musical chairs in the industrial employment market.

Our theory, in contrast, because it assumes that only a Dm's Primary goal-attributes exert active selection power when Dm makes his choice, can tolerate quite significant fluctuations in the relative positions of Dm's organization alternatives with respect to Secondary and Auxilliary goal attributes, i.e. with respect to the majority of Dm's avowed goal dimensions, without therefore predicting that Dm will at once rearrange his "overall preference" rank ordering, and thus jump to the greener side of the fence.

It is instructive to contemplate that a Binary-Utility "Inducements Aspiration-level" model, if utilized in place of the Barnard-Simon Inducements-Contributions Balance scheme, would also predict more stable (step-wise) Decision to Switch behavior for Dms who were continually being faced with closely competitive offers from different organizations.

But our revised model yields yet another reason for expecting Organizational Participation decisions to be rather stable choices. The rationalizing decision rules that Dms construct during Confirmation in order to explain their choices -- rationales which most likely become even more strengthened, elaborate, and explicit as time passes with their actual participation in the organization, so long as Dms' Primary goals are not thereby grossly violated -- will usually bias their predispositions towards, or "loyalty" to, the incumbent organization: Dm's rationalizing rule will now reject all those alternatives that his more direct application of goal-attribute Screening methods would reject, and faster. And the rule may in addition become sufficiently biased to reject even such organizational alternatives as Dm would have considered to be "better" than his current one, had they only been presented for his consideration earlier in the game.

Finally, a decision variable which is not mentioned by Simon-Barnard participation theory, but which obviously could and should be included in any such theory, is Dm's "fixed cost of moving." We may expect that the longer a Dm has been with an organization the more fixed costs he will have built into his continued relationship with it. Consider items such as boss-peer relationships, personal housing investments, children's schooling, on-the-job skills and organizationally idiosyncratic knowledge, personal fiends, pension benefits, etc., all of which are examples of potentially non-transferable assets, that would depreciate dramatically should Dm decide to move, and that must therefore be "over-comepensated" for by a challenging alternative if Dm is to be induced to switch organizations.

B. Organizational versus personal goals in organizational decision making

The relationship between organizational and personal goals seem to be a rather unexplored area in formal organization theory.(28) Some theorists seem to make the implicit assumption that organizational behavior is guided almost entirely by organizational objectives -- arrived at either by consensus, by decree from "above", or through some kind of formal problem-solving means-ends analysis, presumably performed on such constraints as the organization discovers as it attempts to achieve its higher ordered economic or social objectives.

Simon at one point, for example, seems to have prefered viewing individual members' personal goals as being strictly relevant only to our explanation of the latters' binary organizational Participation decisions -- the implication being that for our understanding of organizational role-enacting behavior the personal goal striving of role incumbents would contribute merely an unfortunate noise factor, which can and should be abstracted out of our formal organizational systems analyses.(29)

Other theorists have written as if they believed that organizational behavior could be understood by aggregating (in some unstated manner) the sum total of all individual participants' behavior, which then in turn is usually thought of as if it were entirely determined by the members' striving to satisfy their personal "drives" or motivations, either individually or as primary groups.(30)

Our small contribution to clarification of the organizational versus personal goal question flows fairly naturally from the revised choice model. The hypothesis runs as follows: Organizational constraints and explicit goal requirements surely will, in most cases, specify the boundary limits of role incumbents' behavior in organizations. But the nature of participants' organizational decision-alternative Generation and Evaluation processes are such, according to the GDP-I model, that more than a single organizationally viable, or Acceptable, alternative will in many (most?) cases be uncovered by role incumbents, thus allowing individuals often quite broad opportunity, discretion, or power to bring to bear their personal goals or biases when making what are appropriately recognized as "organizational" decisions. This power we obviously expected will become more pronounced the "higher up" we observe the individuals' roles in the organizational hierarchy and/or the higher are the degree of a role-position's technical specialization requirements relative to the control competences of its supervisory role set.(31)

C. Individuals' power to influence organizational decisions

The argument just expounded, re the predicted frequency of observing a comingling of organizational and personal goals in organizational decision making, obviously has implications for, is indeed partly identical with, any analysis of individual members' influence possibilities in organizations. Yet it is not this part of the theory that interests us more at the moment. Consider instead those points or phases in any organizational decision process at which an individual -- who might otherwise have rather weak "authority" to impose goal premises, and in addition not much role-incumbency opportunity to help process and select among the viable set of organizationally Acceptable alternatives -- could still exercise quite considerable, if usually unrewarded, powers of influence over the organization's allocation of resources and courses of action (apart from the special case of formally unrecognized, socalled gray eminences, who might have the ear of power figures "in the cloak-room").

Briefly, we would expect that innovative individuals would be able to bring to bear on their organizations rather impressive powers of influence in the early phases of decision making, say by drawing to the attention of a "proper authority" the existence of previously unreorganized decision problems, or in helping reclassify, diagnose, and define for further processing by others in their organizations such problems as had till then been left unattended to, often, we might expect, for lack of sufficiently operational or efficient strategies for coping with them.

This type of innovation by decision-making attention-focussing would appear to be an effective influence strategy for internal and external staff consultants to make more deliberate use of, in contrast perhaps to the intense "direct sales" efforts that consultants so often seem to expend in rather futile attempts to convince their client organizations to adopt their own fully developed solutions to problems that are only partly defined, if yet even recognized, by the officials being advised.

D. Organizational innovation implementation

Here is the last organizational implication of our theory of individula decision making to be considered in this paper. This hypothesis relates quite closely to the three above, and is interesting in its own right only because it seems to help clarify some of the prevailing myths about why "perfectly reasonable" organizational decisions, or innovations, fail to get carried out at the implementation stage:

The theoretical concept usually invoked in order to explain decision implementation failure is the so-called "resistance to change" notion. The latter is usually discussed as if it were some sort of generalized trait of human nature, and then in large measure "irrationally" or affectively based, which may be "overcome" through development of interpersonal "trust" between change agent and changee, through some sort of "participative" decision sharing.

Our theory suggests that a good part of the reason why certain decisions fail to get implemented in organizations -- for there are lots of "changes" that are not thus resisted -- is not so much due to a native, affective sort of "contrariness" on part of some organization members, but is more frequently attributable to their often legitimate, quite explicit belief that the proposed innovation is a poor decision, as seen from the vantage-point of the in part personal, yet surely also organizational, goal-sets of such often "lower-level" implementors.

According to this view, one reason why wider participation in the decision process by more organizational members may indeed work in "overcoming resistance to change" is simply that a better decision is thus produced, which takes into account the points of view and goal-attribute perceptions of more of the participants who might later be in a position to bring to bear their quite "rational" objections to the decisions, perhaps then expressed as mute "resistance". This interpretation helps, it seems, in clearing the air of "participation" itself as the explanation of, and as a magic way to achieve, increased solution acceptance and commitment by organization members.(32)

The hypothesis implied by this analysis should now be obvious: Participation in decision-making will work, as an instrument of helping overcome future "resistance" to a proposed change, to the extent that each participant's organizational role constraints and Primary personal goals are thus not violated by the innovation. No elements of "liking" or "interpersonal

trust" need hereby be imputed to the relationships among organization members in order to explain how wider participation in organizational decision making may be an effective strategy for implementation. Note, however, the hypothesis does not rule out our concomitant belief in propositions like:

a. organization members' interpersonal feelings will affect what and how decision information is, respectively, communicated and interpreted between participants during joint problem solving; and

b. interpersonal trust -- in the sense of the existence of unsecured mutual expectations between individuals at different levels, or from different sub-groups in an organization, about the others' perspicacity and fair-mindedness in regard to one's "own" role-problems and goal expectations -- may under certain conditions effectively take the place of explicit mutual guarrantees in assuring a change participant that his role constraints and un-voiced personal objectives will not unwittingly be over-stepped by some other man or sub-group during implementation of the joint, innovating decision.

DIRECTIONS OF FUTURE RESEARCH

We will now no more than touch base with five not specifically organizational areas of research that in the writer's opinion deserve his and others' further investigation:

A. Measurement of goal structure

The separation of Dms' decision Values into Primary and Secondary goal-attribute sets is, although a key concept in the GDP-I model, a classification for which reliable and reasonably efficient ex ante observational instruments have yet to be devised. To date our own coding of Dms' goal-attribute structures has been accomplished largely ex post hoc, from detailed interview decision protocols. Much more desirable in this regard would obviously be a validated framework for generating standard questionnaires, which could be adapted to a wider variety of problem contexts for identifying Dms' Primary vs. Secondary goal attributes before Implicit Choice takes place, if indeed the latter Value classification can be shown to hold up under further scrutiny.

B. Utilization of uncertainty indices in decision making

One of the more unusual properties of the GDP-I model is perhaps its implication that it is redundant and potentially misleading for us to represent most Dms' responses to decision uncertainty as if Dms estimated, and subsequently performed arithmetic operations with, sets of quantitative Uncertainty indices, which in turn modify the scalar Values that Dms allegedly assign to perceived consequences of their Uncertain alternatives -- as has usually been assumed by the traditionally employed

Personal Probability or Potential Surprise measures: Our insistence on trying to carry over the analytical elegances of Probability theory into empirical descriptions of choice behavior is likely to lead us to ask questions of a Dm's Felt Decision Uncertainty to which the latter may well be trained to provide semantically meaningful answers, but which (predicts the GDP-I model) will turn out to be of little or no help to us in piecing together a positive theory of how Dms respond pragmatically to perceived Uncertainty in decision making.

It is important for us to examine, therefore, the extent to which Uncertainty represented in terms of no more than Likely or "probable" ranges of Value ratings, along the Uncertain goal attributes of (allegedly Uncertain) alternatives, will be both a descriptively accurate as well as computationally sufficient manner of representing Uncertainty, in a number of widely different decision situations.

By the same token, it would be desirable to observe in more systematic detail how Dms in different choice contexts operate with Uncertainty Value-ranges (if they do), when resolving Indifference conflicts arising from their initial inability to rank-order given decision alternatives in multidimensional space.

One obvious Uncertainty-estimate hypothesis would for example be that each alternative, when initially encountered by Dm, starts out having a wide range of Likely Value-ratings, i.e. "much Uncertainty", associated with most all of its goal-attributes: By Dm's successive rounds of Search-investigation of the alternative these goal-attribute ranges are then gradually reduced, perhaps to unique Value points eventually.

Three subsidiary hypotheses might also appear reasonable, namely that Dms would not:

i. try to reduce all of their goal-attribute ratings of new alternatives to single, unique Value points before judging Acceptable alternatives to be Acceptable;

ii. make use of some sort of fixed or a priori measurable "Uncertainty Acceptability" level for determining "minimum acceptable range" cut-off-points-for-investigation with respect to the Value ratings of their alternatives; nor

iii. try to compare the Uncertainty associated with one goal attribute (or consequence) with the Uncertainty associated with another attribute (or consequence) along any sort of ordered metric, be it ratio-scaled, cardinal, ordinal, or otherwise.

C. Generalization of GDP-I into another Generate-and-Screen type choice context

Although the claim has been glibly made that our GDP-I model is "generalizable" the proof of this contention is clearly yet to come. In other words, we will want to test the GDP-I hypotheses in contexts somewhat different from occupational choice situations. Yet it seems reasonable that our initial stabs at empirical generalization shall more profitably be made in decision situations we knew beforehand would be fairly well characterized by socalled Generate-and-Screen type Searches for alternatives -- so far a central feature of the model. That is to say, we might first look for choice problems to study in which each new decision alternative was an a priori well-defined and easily recognizable entity, and in which the total number of alternatives usually examined by Dms would be reasonably large (say at least four).

Decision contexts that fit this bill rather well abound in the field of industrial management: Consider such obviously GS-type problems as: company merger decisions, key managerial personnel selections, plant location, new product investment commitments, major equipment purchasing, or, more generally, any capital investment decision for which no single pay-off dimension is clearly accepted as being the measure by which choice alternatives are to be rank ordered.

D. Elaboration of the GDP-I model in Design-Test-and-Modify type choice contexts

Having made the statement that Generate-and-Screen type contexts ought to be differentiated from Design-Test-and-Modify decision situations it behooves us to explain in more detail, obviously, just how our GDP-I model is to be modified in order also to be able to account for the latter type of choice phenomena. Although it is the author's belief that most of the basic structure of the GDP-I model can be carried over into our analyses of more typically DTM problem solving, the latter type of situation yet remains to be subjected to the degree of detailed on-line observations of its decision processes that was the main plank of investigation in our occupational choice studies.

Areas like technological systems (component) research and development, marketing strategy design, company sub-division reorganization decisions, departmental educational policy evolution, or legislative proposal construction -- particularly if instances of such decision processes can be found that are made, or least closely monitored, by single key individuals -- are indeed highly tempting areas for future DTM-type model generalization efforts.[32a]

E. Investigation of the GDP-I modifications necessary in order to explain group decision processess:

The traditional manner of relating group to individual problem-solving has been to ask "who would produce better decisions, individuals working alone or as a group?" The answers provided to date have been highly equivocal, as might perhaps be expected, focussing as most of these researches have done on the output of group versus individual decision making.(33) Most of the intriguing questions thus still remain to be asked, namely what are the more basic differences, if any, between group vs. individual decision processes?

An immediately obvious question in light of our study is, for example, will Choice Confirmation be as pronounced an aspect of joint decision making as it seems to be for individual Dms?(34) How will the decision process description have to be reconceptualized in order to account for cases where task and/or personal conflicts exist among group members?

The spectrum of possibilities for research based firmly in careful and systematic longitudinal observations of multiperson choice processes in real life situations is of course over-whelmingly large. Consider merely some of the likely effects on the path of decision making of such traditionally studied variables like:

i. distribution of status, power, or leadership responsibilities among group members;

ii. distribution of initial positions taken or not taken, or of the available information and expertise, among group members;

iii. type and degree of formality of the groups' rules of procedure, and/or mode or channels of interpersonal communications;

iv. recent past history of interpersonal relations among members of the group;

v. present group climate variables like "cohesiveness", "openness," "structural integration", "commitment to task", etc.(35)

We have hardly yet begun, it seems, to collect adequate process data on the basis of which to formulate reasonably adequate models for explaining the differential effects on group decision-behavior of the above variables(36) -- let alone of others that we yet know not enough about even to conceptualize.

The opportunity to join in on doing this type of research should thus be rather obvious.

NOTES AND REFERENCES

1. P. Soelberg, "Interview process analysis of occupational choice behavior," Sloan School of Management, Massachusetts Institute of Technology, 1966.

1a. Ibid; and P. Soelberg "Longitudinal questionnaire process analysis of occupational choice," Sloan School of Management, Massachusetts Institute of Technology, 1966.

2. See for example G.P.E. Clarkson, Portfolio selection, a simulation of trust investment, Englewood Cliffs, New Jersey: Prentice Hall, 1962.

3. L. Festinger, Conflict, decision, and dissonance reduction, Stanford University, 1964.

4. Ibid.

5. Soelberg, "Longitudinal questionnaire analysis...," op. cit.

6. Ibid.; supra.

7. See for example, R.D. Luce and H.Raiffa, Games and decisions, New York: Wiley, 1957; W. Edwards, "Behavioral decision theory", Annual Review of Psychology, 12, 1961, pp. 473-498; and, except for the contributions of H.A. Simon et al, D.W. Taylor, "Decision making and problem solving, in J.G. March (ed.), Handbook of organizations, Chicago: Rand McNally, 1965, pp. 48-86.

8. H.A. Simon, The new science of managment decisions, New York: Harper, 1960; G.L.S. Shackle, Decision, order, and time in human affairs, Cambridge University, 1961.

9. Soelberg, "Interview process analysis...", op.cit.

10. J.S. Chipman, "The foundations of utility", Econometrica, 28, 1960, pp. 193-224.

11. Consider for example the structure of sub-goals produced by A. Newell, J.C. Shaw, and H.A. Simon's General Problem Solver model in this light (Psychol. Rev., 65, 1958, pp. 151-166).

12. H.A. Simon, "On the concept of organizational goal", Adm. Sci. Quatr., 9, 1964, pp. 1-22.

13. See J.G. March and H.A. Simon's model of "adaptive motivated behavior" in Organizations, New York: Wiley, 1958, pp. 47-50.

14. P. Soelberg, "A generalizable decision process model, GDP-I", Sloan School of Management, Massachusetts Institute of Technology, 1966, p.47.

15. _____, "Longitudinal questionnaire process analysis....", op. cit.

16. _____, "A critical review of theories of problem solving and decision behavior, Part A", Sloan School of Management, Massachusetts Institute of Technology, 1966.

17. e.g. R.J. Bjelland, "Probability estimation under conditions of varying uncertainty", Masters thesis, Sloan School of Managment, Massachusetts Institute of Technology, 1965.

18. e.g. R.M. Thrall, C.H. Coombs, R.L. Davis, (eds), Decision Processes, New York: Wiley, 1954; "A symposium on game theory", Behavioral Science, 7, 1962, No. 1.; R.D. Luce, Individual choice behavior, New York, Wiley, 1959; W. Edwards, op. cit;

19. See the various methods for dealing with Uncertainty in their decision making described by Dms, in Soelberg, "Interview process analysis...", op. cit.

20. H.A. Simon, "A behavioral model of rational choice," Quatr. J. of Econ., 69, 1955, pp. 99-118.

21. Soelberg, supra.

22. Simon, supra.

23. See Soelberg, "A Critical review...", op. cit.

24. _____, "GDP-I", op.cit.

26. For further discussion of sub-set of March and Simon's propositions see Soelberg, "A critical review," op. cit; and "Structure of individual goals: Implications for organization theory," Sloan School of Management, Massachusetts Institute of Technology, 1966.

27. See March and Simon, op.cit., pp. 84-88.

28. Soelberg, "Structure of individual goals...", op.cit.

29. Simon, "On the concept of organizational goal," op.cit.

30. This view seems to have been fairly prevalent among more traditionally oriented industrial psychologists. Consider for example the motivational assumptions of N.R.F. Maier, Psychology in industry, Boston: Houghton Mifflin, 1955, and surely the socalled "human relations" point of view of organizational behavior that grew out of the findings of F.J. Roethliesberger and W.J. Dickson, Management and the worker, Cambridge,

Mass: Harvard, 1939. Recently, however, traditionally trained psychologists have increasingly begun calling for better integration of the microcosmic view of individual/primary-group behavior with a larger systems view of organizational process and structure. See for example E.H. Schein, Organizational psychology, Englewood Cliffs, N.J.: Prentice Hall, 1965; or D. Katz and R.L. Kahn, The social psychology of organizations, New York: Wiley, 1966.

31. For further development of the hypothesis see Soelberg, "Structure of individual goals: Implications for organization theory", op. cit.

32. Although we may have learned to accept with a grain of salt the early diagnoses as offered by L.Coch and J.R.P. French ("Overcoming resistance to change," Hum. Relat., 1, 1948, pp. 512-532), A. Zander ("Resistance to change, its analysis and prevention" (reprinted in W.G. Bennis, K.D. Benne, and R.Chin (eds), The planning of change, New York: Holt, 1961, pp. 543-548), et al,-- of viewing changee-participation in decision making as both a necessary and sufficient condition for "overcoming resistance to change," particularly perhaps in view of the equivocal data on that score reported by French, Israel, and Ås ("An experiment in participation in a Norwegian factory", Hum. Relat. 13, 1960, pp. 3-19) -- yet it seems that the rather explicit, cognitive, and usually easily observable objections that changees often do voice against "changing" have gotten severely underplayed, by change theorists' focussing largely on "psychological", more or less affective, variables as the chief means of explaining "resistance" phenomena. [One wonders, for example, if from organizationally non-participating workers' point of view one of their main reasons for "resisting" is not often their frequently well-founded, and quite explicitly cognitive("rational"?) belief that if they went along with the change they were likely to get "screwed" on one or more of the goal-attributes that they considered to be important on their job -- either without sufficient recompense or without flexibility to adjust for unforeseen losses from the change, after it had been successfully implemented.]

32a. W.D. Putt has recently proposed extending the model to descriptions of the decision-to-bid design process of technical companies competing for government R-and-D contracts.

33. We have discussed some of the merits of this research strategy [dating from the day of M.E. Shaw, "A comparison of individuals and small groups in the rational solution of complex problems," Am. J. Psychol., 44, 1932, pp. 491-504; to C.P. Duncan, "Recent research on human problem solving", Psychol. Bull., 56, 1959, pp. 397-429] elsewhere, in Soelberg, "A critical review...," op.cit.

34. Evidence reported by L.R. Hoffman in a recent talk (February, 1966) to the M.I.T. Sloan School of Management, Organization Effectiveness Seminar, entitled "Sophisticated individuals and naive groups," suggests that Confirmation processing is indeed a readily observable feature of the group decisions that Professor Hoffman has studied.

35. See also J.W. Thibaut and H.H. Kelley, The social psychology of groups, New York: Wiley, 1959, and D. Cartwright and A. Zander Group dynamics, Evanston, Ill: Row, Paterson, 1960, for a description of other relevant variables of this category.

36. R.T. Golenbiewski, "Small groups and large organizations", in J.G. March (ed) Handbook of organizations, Chicago: Rand McNally, 1965, pp. 87-141.